



# TEST REPORT

Date: 2014.03.31

Report no.: 300-ELAB-2064

Page 1 of 18

Init.: TNJ/APOD/LSHA

Order number: 593474

No. of appendices: 6

---

**Requested by:** Contact person: Jannich Hansen

Company: Nordjysk Bioenergi ApS      www.nordjysk-bioenergi.dk

Address: Brinken 10      Email: jannich@nbe.dk

Town: DK-9750 Øster Vrå      Tel.: +45 8820 9230

---

**Product:** Automatic biofuel boiler

Manufacturer: NBE Production A/S      Type: RTB 30

Nominal output: 25.2 kW      Fuel: C1 (wood pellets)

---

**Deadlines:** Date of receipt: 2014.03.10

Date of testing: 2014.03.11- 2014.03.17

---

**Procedure:** Testing of biofuel boiler according to DS/EN 303-5:2012.

---

**Result:** Requirements according to DS/EN 303-5:2012 Class 5 were met.

---

**Remarks:** See page 2. This is a translation of test report originally dated 2014.03.31. In case of doubt, the Danish version of the test report prevails.

---

**Terms:** Testing has been carried out on the conditions stated overleaf in compliance with the guidelines laid down for the laboratory by DANAK (Danish Accreditation) and in compliance with DTI's General Terms and Conditions Regarding Commissioned Work Accepted by the Danish Technological Institute (DTI), February 2013. The test results apply to the tested samples only. This test report may be reproduced in extracts only if the laboratory has approved the extract in writing.

---

**Place:** Danish Technological Institute, Energy Laboratory



**Signature:** Torben Nørgaard Jensen  
B.Sc.



## **Appendices:**

- a) Drawings of the biofuel boiler: ASM\_00243 (2014.02.12), ASM\_00053 (2014.03.), Auger 160mm (2014.02.21), Skamol – 137 x 150 (2014.03.19), R4546 (2014.03.19).
- b) Photos of the biofuel boiler and steering: 21 pcs. of boiler and 5 pcs. of steering.
- c) User's instructions, installation manual: RTB Ready to Burn, Approved 2014.03.25
- d) Technical information: Approved 2014.03.25
- e) Dataplate: RTB30, verified 2014.03.25
- f) Risk assessment signed 2014.03.21

The appendices are kept separately

## **1 Remarks**

Control of the welded steel sheet boiler, electrical safety and EMC are not included in this report (see paragraph 4).

Determination of particle emission at in-stack sampling with turbular filter device. Drying was carried out before and after sampling at 105 °C for minimum 4 hours.

## **2 Description of the biofuel boiler**

The Ready To Burn boiler is a compact fully automatic stoker boiler for stoking with dispersed solid fuel. The fuel is transported by means of an inclined auger from the storage hopper further on via a drop chute to an internal auger in the burner. Combustion takes place during supply of primary and secondary air.

RTB is performed with electrical ignition, compressor cleaner and compressor.

The boiler is not suited for wood burning.

The regulation system is fully modulating. Measurements on smoke- and flow temperature are continuously carried out.

The boiler is a welded steel sheet boiler with a convection part consisting of a pass with four flue gas turbulators.

The unit is equipped with ascending auger feeding and a drop chute larger than 250 mm to secure against back burning in the fuel supply.

Report no.:  
Date:  
Init.:  
File:

300-ELAB-2064  
2014.03.31  
TNJ/APOD/LSHA

\\\\localdom.net\TI Folders\Organization\C068\_Biomasse og Bioraffinering\ELAB\Drift\Kedler\PST  
Kedelaforvninger\Prøvningsrapporter\300-ELAB-2064 - NBE Production - RTB 30\_UK.docx



**DANISH  
TECHNOLOGICAL  
INSTITUTE**





**Safety equipment:**

Boiler thermostat type: ..... Electronic  
Safety thermostat: ..... CA-95A, set point 95 °C  
Protection against back burning: ..... drop chute security with set point 70 °C  
Protection against back burning: ..... Drop chute >250 mm

Stand-by power consumption (measured) ..... 2.4 W

**Settings on unit during testing:**

Operating thermostat (nominal): ..... 85 °C  
Operating thermostat (partial load): ..... 71 °C  
(Further information regarding settings of biofuel boiler during testing see appendix)

**Feeding system:**

Type: ..... Feeding by means of inclined auger  
Fuel engine external<sup>1</sup>: ..... Linix YN70-20, 20W v. 1200 o/min.  
Fuel engine internal: ..... Linix TY60-220-8-8, 6W v. 8 o/min.

**Burner:**

Type: ..... aircooled hearth with fireresistant crossbar  
Width: ..... 97 mm  
Depth: ..... 191 mm  
Fan: ..... SOHON, type FL085034Y-01E, 230V, 43W

**Boiler:**

Type: ..... welded steel sheet boiler  
Height: ..... 1075 mm  
Width: ..... 655 mm  
Depth: ..... 850 mm  
Water content: ..... 48 L  
Flue gas tubes: ..... ø100 mm  
Flow connection: ..... 3/4"  
Return connection: ..... 3/4"  
Weight: ..... 179 kg

---

<sup>1</sup> During testing



### 3 Test equipment

Testing stand and equipment has been set up according to EN 303-5 and EN 304.

<b>Rack B1</b>			
<b>Instrument</b>	<b>Type</b>	<b>Traceability</b>	<b>No.</b>
Datalogger	HP 34970A	DANAK 200	270-A-2436
PC	Dell	-	-
CO-gauge	Sick Maihak Sidor	-	270-A-2430
CO/CO <sub>2</sub> -gauge	Sick Maihak Sidor	-	270-A-2432
FID analyzer	Sick Maihak EuroFID		270-A-2434
NO <sub>x</sub> -gauge	ECO Physics CLD	-	270-A-2428
Pressure gauge	Autotran 700	ELAB	270-A-2479
Heated hose/probe	M&C	-	270-A-2482
Heated hose/probe	M&C	-	270-A-2483
Flue gas temperature sensor	Type K	ELAB	270-A-2488
Ambient temperature sensor	Type K	ELAB	270-A-2487

<b>Test stand 1</b>			
<b>Instrument</b>	<b>Type</b>	<b>Traceability</b>	<b>No.</b>
Water flow meter	0-3,5 m <sup>3</sup> /h	DANAK 200	270-A-1175
Water temperature sensor	Pt100 (forward)	DANAK 200	270-A-1494
Water temperature sensor	Pt100 (return)	DANAK 200	270-A-1493
Gas meter	IGA AC-5M	DANAK 207	270-A-1475

<b>Test stand 2</b>			
<b>Instrument</b>	<b>Type</b>	<b>Traceability</b>	<b>No.</b>
Vandflowmåler	0-3,2 m <sup>3</sup> /h	DANAK 200	270-A-1511
Vandtemperaturføler	Pt100 (forward)	DANAK 200	270-A-2285
Vandtemperaturføler	Pt100 (return)	DANAK 200	270-A-2286
Gasmåler	IGA AC-5M	DANAK 207	270-A-1475

<b>Other equipment</b>			
<b>Instrument</b>	<b>Type</b>	<b>Traceability</b>	<b>No.</b>
Adiabatic calorimeter	-	IVC, Kemi	-
Spangas, C <sub>3</sub> H <sub>8</sub>	AGA	Swedac	270-A-2294
Spangas, CO/CO <sub>2</sub>	AGA	Swedac	270-A-1727
Spangas, NO/SO <sub>2</sub>	AGA	Swedac	270-A-1725
Zero gas, N <sub>2</sub>	AGA	Swedac	270-A-1731
Data collection programme	N.I. Labview	-	TI-DOP ver. II
Dust measuring equipment	Ströhlein	-	270-A-1330
Surface thermometer	Technoterm 5500	DANAK 200	270-A-976
Water gauge	ELAB	-	270-A-1759
Scale (dust)	Mettler XS 204	ELAB	ID: 7084
Scale (humidity)	Mettler PC 440	ELAB	270-A-947

Report no.: 300-ELAB-2064  
Date: 2014.03.31  
Init.: TNJ/APOD/LSHA  
File:

\\localdom.net\TI Folders\Organization\C068\_Biomasse og Bioraffinering\ELAB\Drift\Kedler\PST  
Kedelafterprøvninger\Prøvningsrapporter\300-ELAB-2064 - NBE Production - RTB 30\_UK.docx



**DANISH  
TECHNOLOGICAL  
INSTITUTE**

Scale (fuel)	Sauter 60 kg	ELAB	270-A-484
Scale (fuel supply)	Mettler IND 560	ELAB	270-A-2424



## 4 Requirements for construction etc.

	Reference paragraph in EN303-5	Requirement met
<b>4.1 General requirements</b>		
Safety during normal use	4.1	Yes
<b>4.2 Requirements for documentation</b>		
Drawings	4.2.1.1	Yes
Quality manual	4.2.1.2	Yes
Data plate	7.1-7.2	Yes
Technical information	8.2	Yes
User's instructions	8.3	Yes
Risk assessment	4.3.1	Yes
<b>4.3 Requirements on welded steel sheet boiler</b>		
Execution of welding work	4.2.2.1	*
Welding seams and fillers	4.2.2.2	*
Parts of steel subject to pressure	4.2.2.3	*
Least wall thickness and tolerances	4.2.2.4	*
<b>4.4 Requirements on safety and design</b>		
Venting etc.	4.2.4.1	Yes
Cleaning of heating surfaces	4.2.4.2	Yes
Inspection of the flame	4.2.4.3	Yes
Water tightness	4.2.4.4	Yes
Spare parts	4.2.4.5	Yes
Water side connections	4.2.4.6	Yes
Thermostat pockets	4.2.4.7	Yes
Thermal insulation	4.2.4.8	Yes
Water side resistance	4.2.4.9	Yes
Storage hopper	4.2.4.10	Yes
Combustion chamber	4.2.4.11	Yes
Ash chamber	4.2.4.12	Yes
Overfeeding and disturbances in the fuel supply	4.3.4	Yes
Supply of combustion air	4.3.5	Yes
Surface temperatures of accessible parts	4.3.6	Yes
Leakage of combustion products	4.3.7	Yes
<b>4.5 Safety requirements in connection with stoking</b>		
Generally	4.3.3.1	Yes
Manual fuel supply	4.3.2	Not relevant
Automatic fuel supply	4.3.3	Yes
Thermal conduction	4.3.3.2	Yes



Back flow of inflammable combustion gasses	4.3.3.3	Yes
Spreading of fire in fuel line	4.3.3.4	Yes
Alternative solutions against back-burning	4.3.3.5	Not relevant
<b>4.6 Safety requirements at automatic stoking</b>		
Temperature control for open vented systems	4.3.8.2	Yes
Temperature control for closed vented systems	4.3.8.3	Yes
Accessories	4.3.9.1	Yes
Electric safety	4.3.9.2	*
Electromagnetic compatibility, EMC	4.3.9.3	*

---

\* Not included in this report. Reference is made to the manufacturer's EU declaration of conformity.





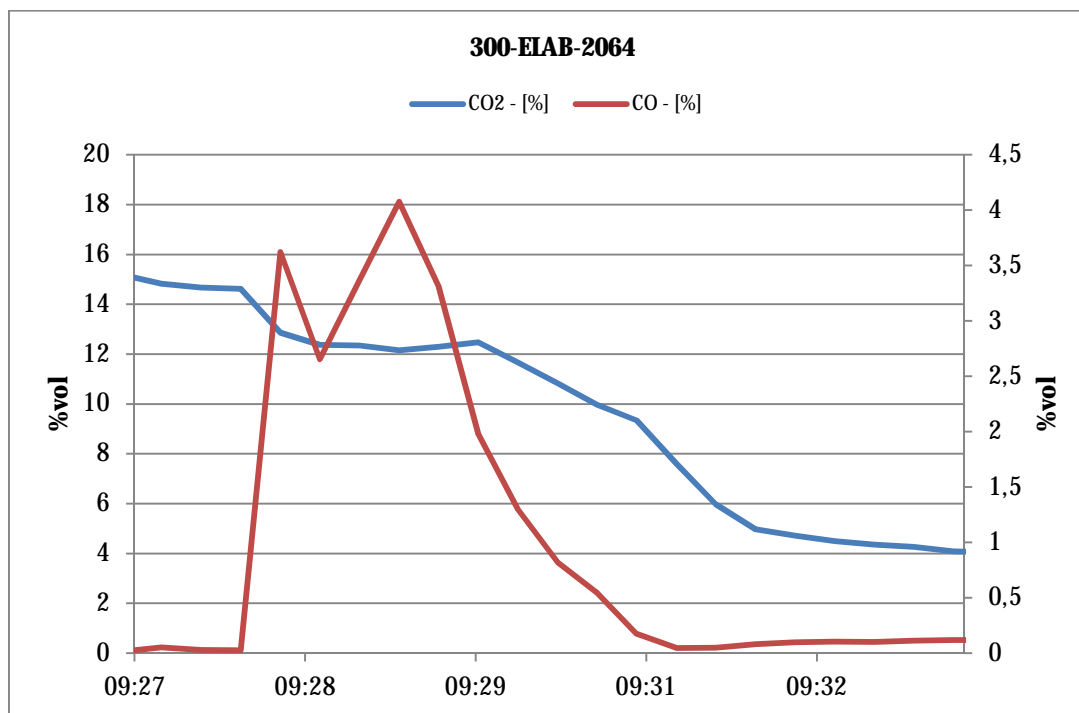
## 5 Test results

### 5.1 Water resistance

Equivalent temperature difference at nominal output	Water flow	Drop of pressure
20 K	1.1 m <sup>3</sup> /h	7 mbar
10 K	2.2 m <sup>3</sup> /h	26 mbar

### 5.2 Disconnection of air fan

	Measured CO	Allowed limit CO
Disconnection of air fan	4.1 %vol	5 %vol



### 5.3 Surface temperatures

	Measured temperature	Allowed limit
Boiler doors etc., average of 5 measurements	24 °C	+ 100 K
Boiler's underside, average of 5 measurements	31 °C	+ 65 K
Handles being touched during operation		
Metal and similar materials	-	+ 35 K
Porcelain and similar materials	-	+ 45 K
Plastic and similar materials	-	+ 60 K
Boiler's average surface temperature		



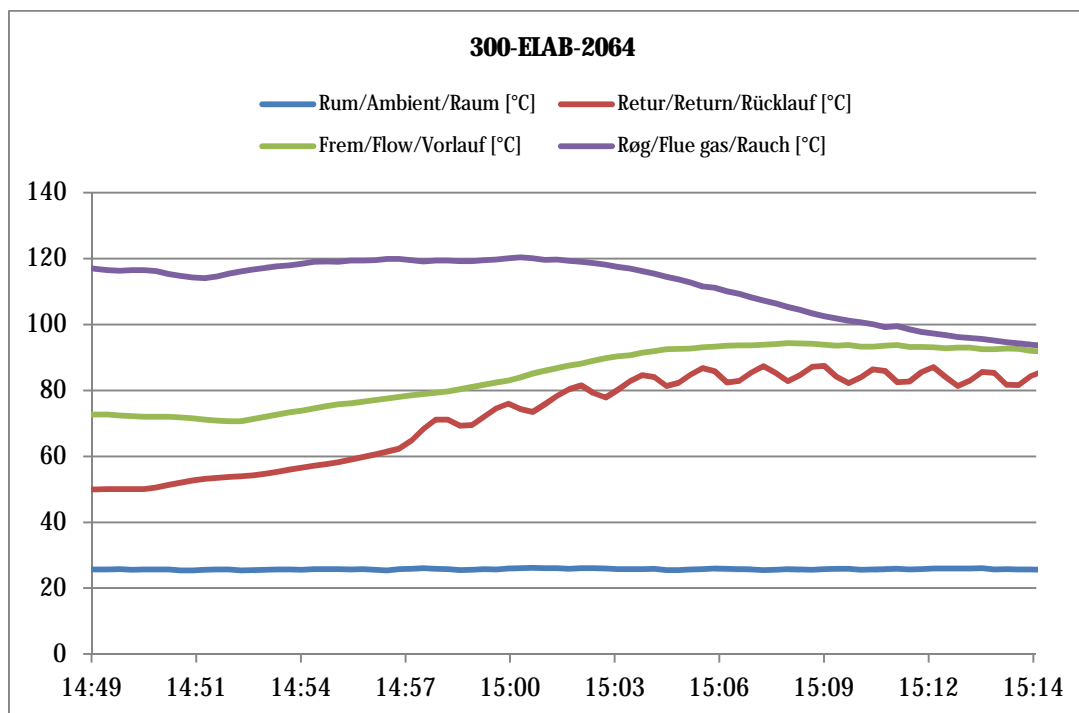
Average of 10 spot measurements	29 °C	-
Ambient temperature	25 °C	-

#### 5.4 Function control

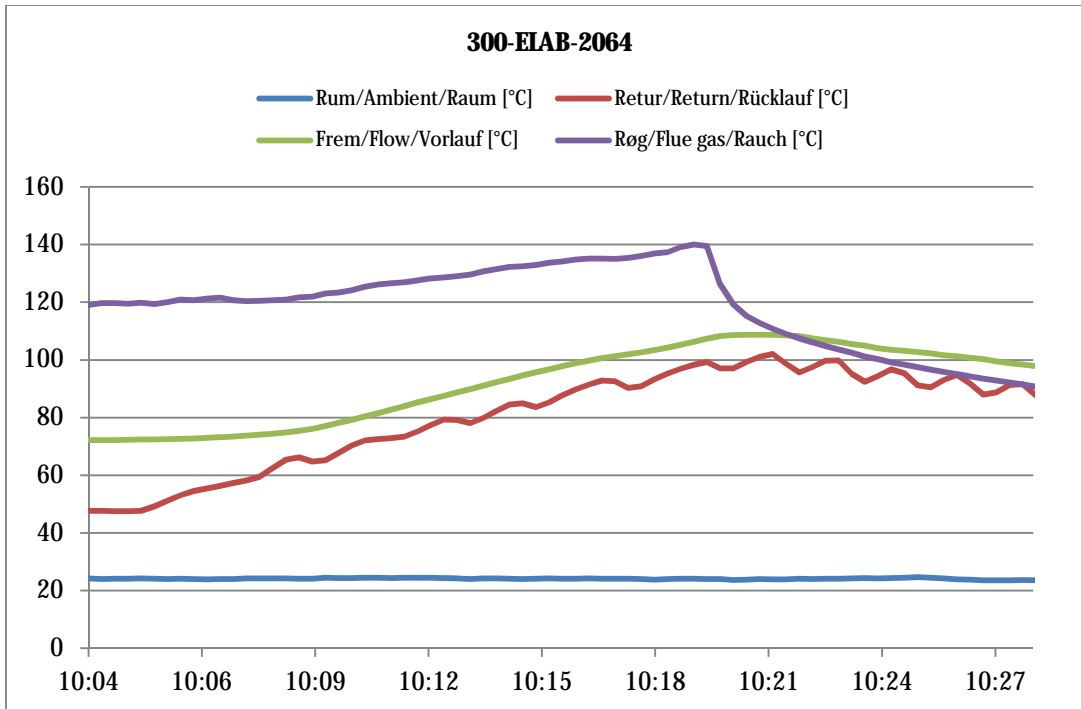
The stoking system is completely disconnectable, DS/EN303-5 paragraph 4.3.8.3 a), and therefore the safety equipment includes an operating thermostat and a safety thermostat with manual reset device.

The thermostats of the boiler are tested in accordance with DS/EN303-5 paragraph 5.13. Loss of power supply and sudden lack of heat offtake are controlled in accordance with paragraph 5.14.

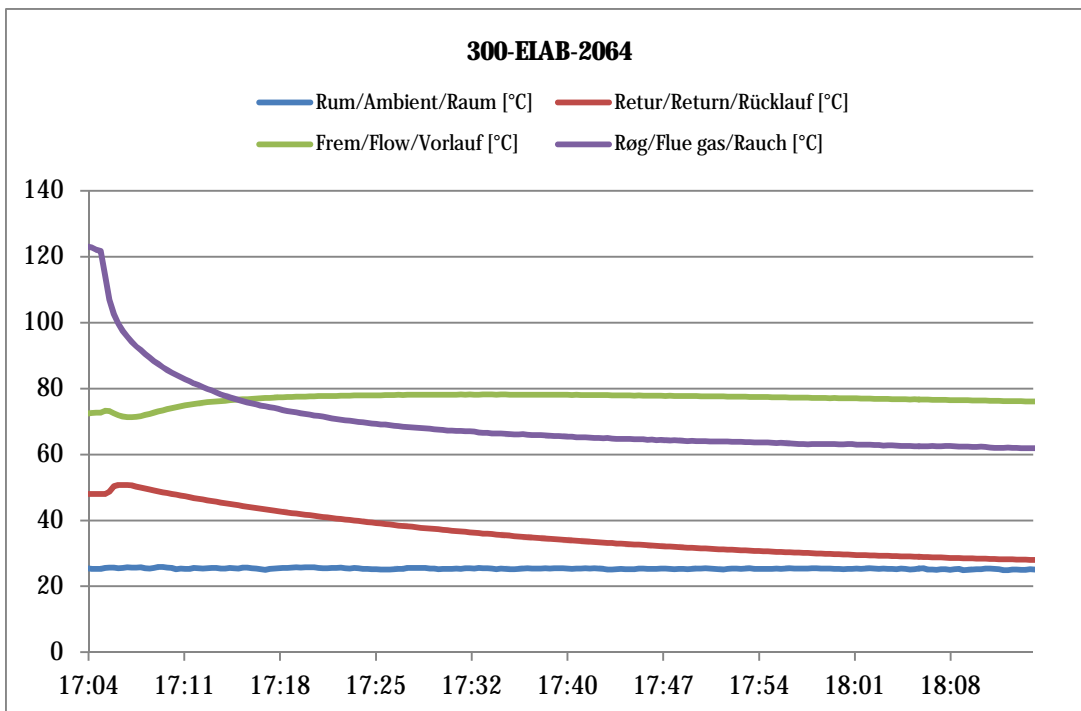
	Measured temperature	Allowed limit
Operating thermostat	94.4 °C	100 °C
Safety thermostat	108.7 °C	110 °C



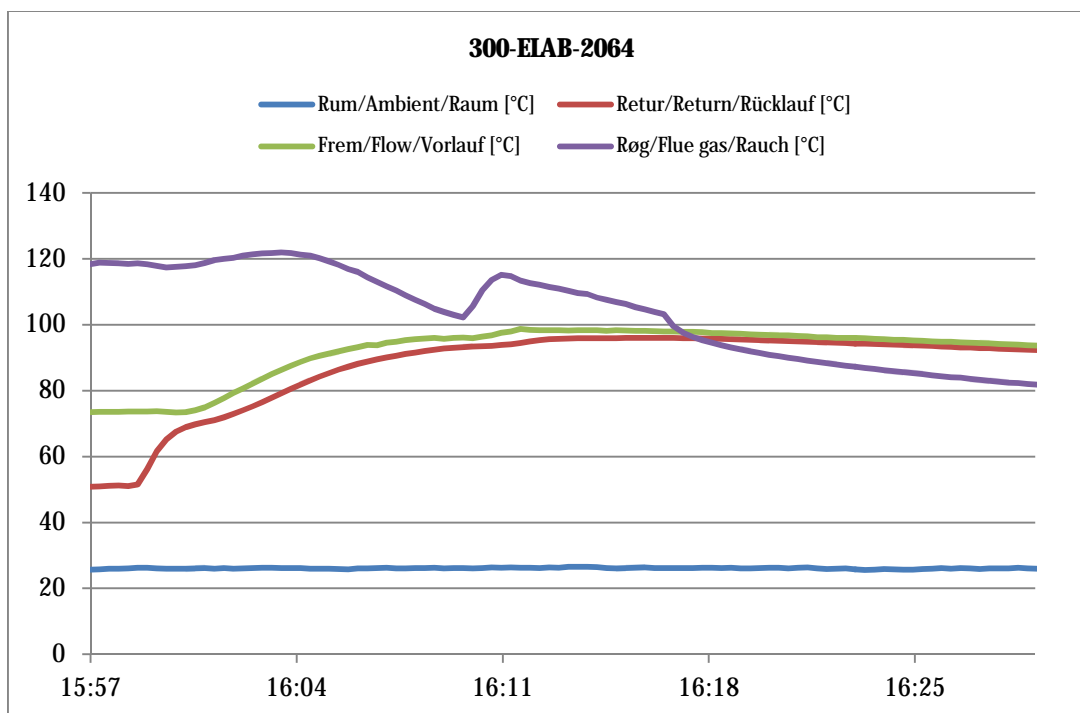
Test of operating thermostat



Test of safety thermostat



Test of power failure



Test of loss of effect

## 5.5 Pressure test of boiler shell

The necessary tests cf. DS/EN303-5 paragraph 5.4, are carried out by the manufacturer.

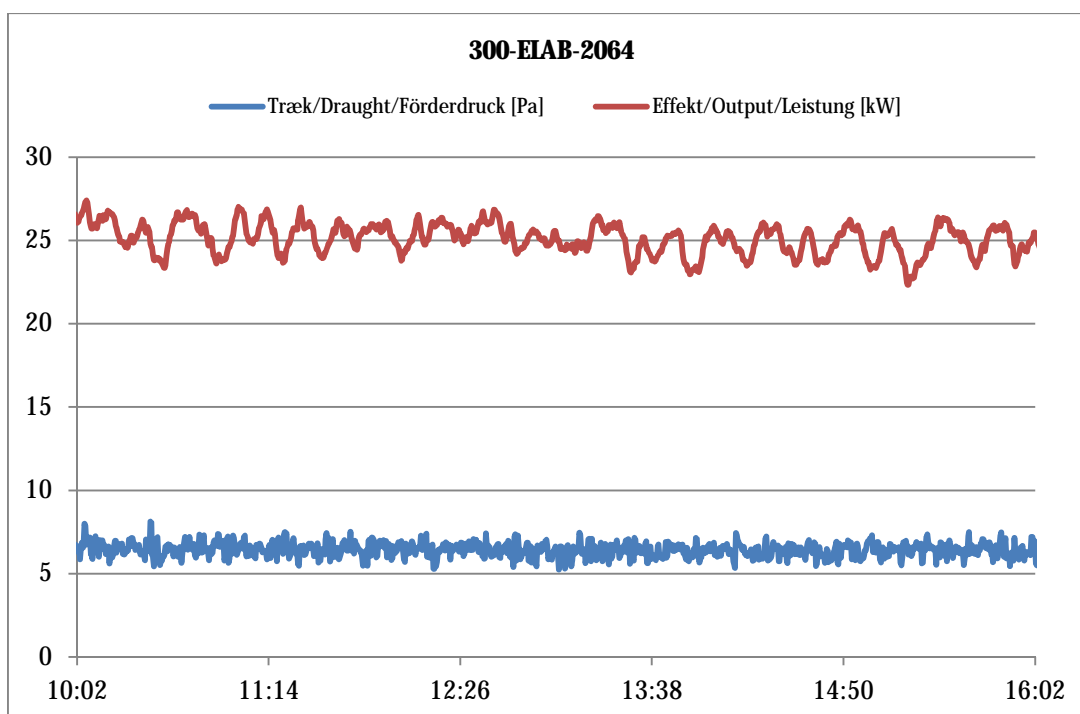
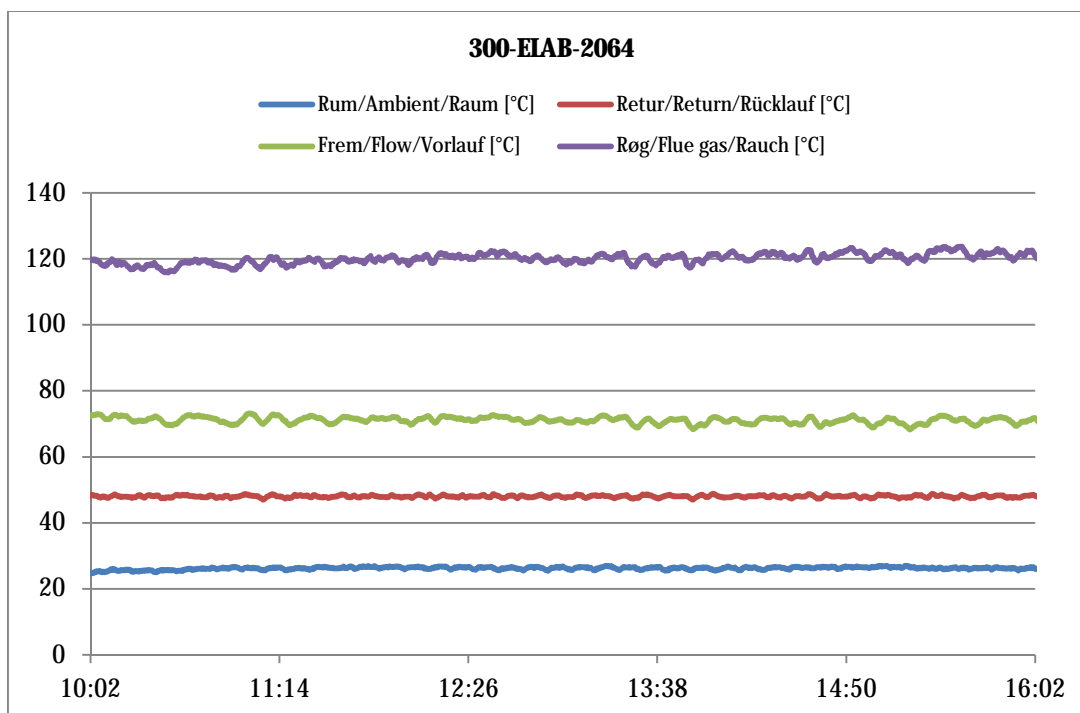


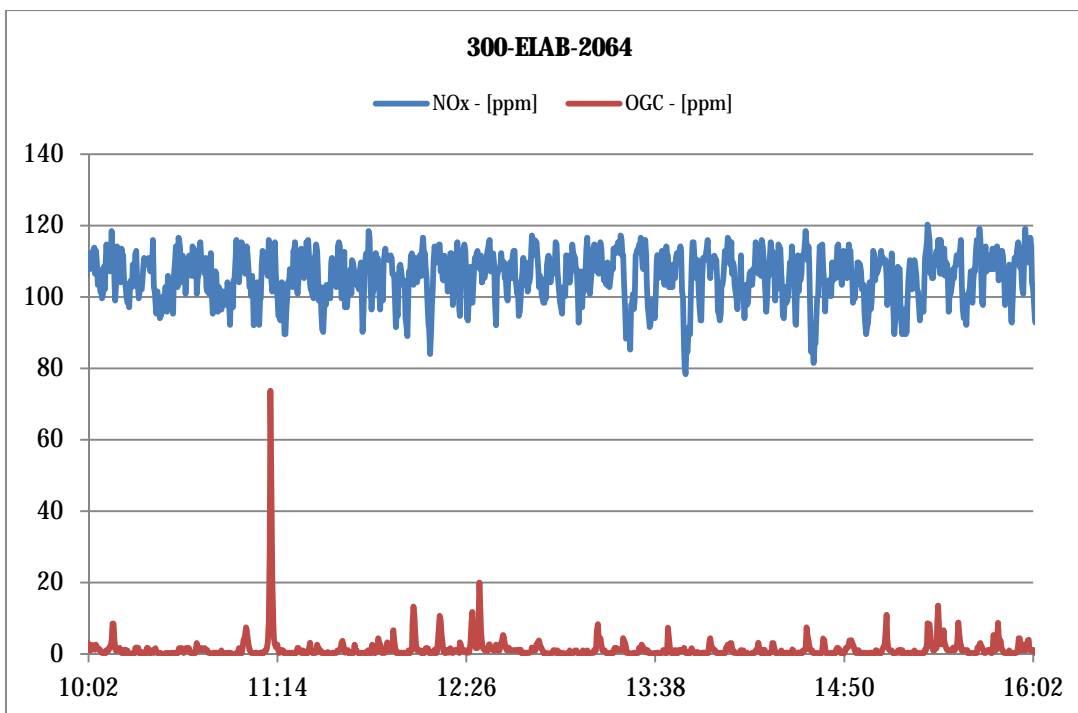
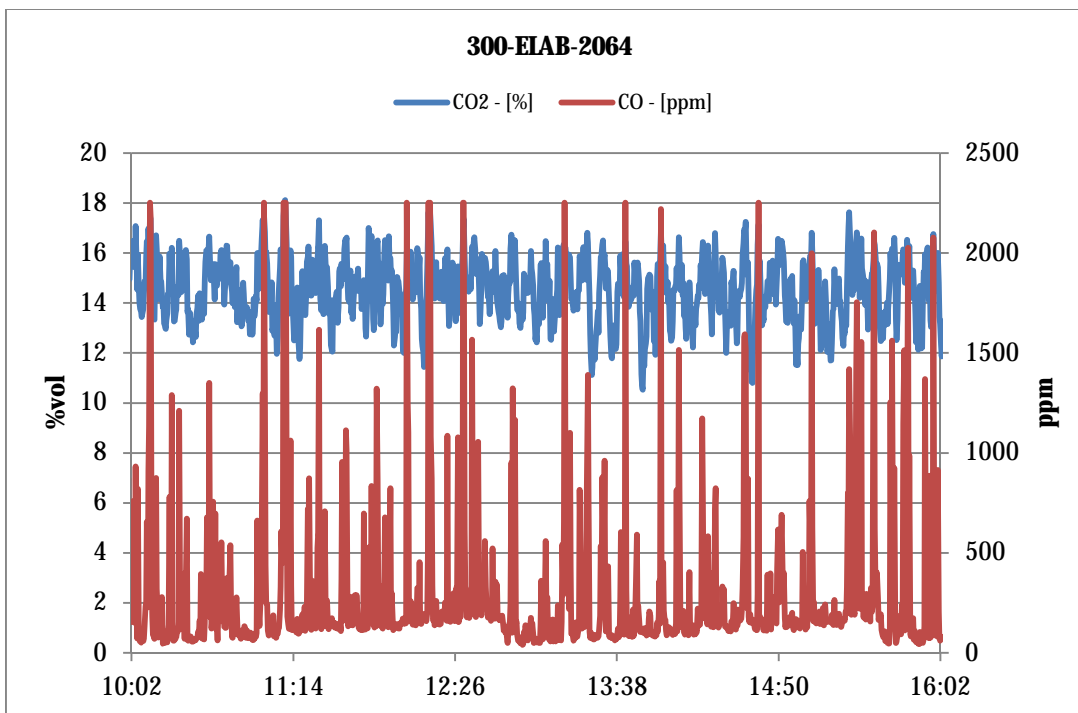
## 5.6 Test results at nominal output

Measurement	Result	Demands
Return temperature	48.01 °C	
Flow temperature	71.12 °C	
Water flow	0.95 m <sup>3</sup> /h	
Heat output	25.23 kW	
Test duration	6.00 h	
Power consumption	90.33 W	
Fuel consumption	5.60 kg/h	
Water content	6.9 %	
Calorific value	17750 J/g	
Heat input	27.61 kW	
Efficiency	91.4 %	88.4 (Class 5) 88.4 (Denmark) 83 (Austria)
Ambient temperature	26 °C	
Flue gas temperature	120 °C	
Chimney draught	6 Pa	
Flue gas volume flow	54.6 m <sup>3</sup> /h	
Flue gas mass flow	49.4 kg/h	
CO <sub>2</sub>	14.6 % <sub>vol</sub>	
Dust measured	37 mg/m <sub>n</sub> <sup>3</sup>	
Dust at 10% O <sub>2</sub>	27 mg/m <sub>n</sub> <sup>3</sup>	40 (Class 5)
Dust at 13% O <sub>2</sub>	0.0196 g/m <sub>n</sub> <sup>3</sup>	0.1/0.02* (Germany)
Dust emission	13 mg/MJ	40/20* (Austria)
CO measured	0.0288 % <sub>vol</sub>	
CO at 10% O <sub>2</sub>	0.0208 % <sub>vol</sub>	
CO at 10% O <sub>2</sub>	259 mg/m <sub>n</sub> <sup>3</sup>	500 (Klasse 5)
CO at 13% O <sub>2</sub>	0.1887 g/m <sub>n</sub> <sup>3</sup>	0.5/0.4* (Germany)
CO at 13% O <sub>2</sub>	189 mg/m <sub>n</sub> <sup>3</sup>	300 (Switzerland)
CO emission	122 mg/MJ	250 (Austria)
NO <sub>x</sub> (NO <sub>2</sub> ) at 10% O <sub>2</sub>	0.0076 % <sub>vol</sub>	
NO <sub>x</sub> (NO <sub>2</sub> ) at 10% O <sub>2</sub>	157 mg/m <sub>n</sub> <sup>3</sup>	
NO <sub>x</sub> emission (NO <sub>2</sub> )	73 mg/MJ	150/100* (Austria)
OGC (C <sub>3</sub> H <sub>8</sub> ) at 10% O <sub>2</sub>	< 0.0004 % <sub>vol</sub>	
OGC (C) at 10% O <sub>2</sub>	< 6 mg/m <sub>n</sub> <sup>3</sup>	20 (Class 5)
OGC emission (C)	< 3 mg/MJ	30 (Austria)

All emission values are stated on the basis of dry flue gas.

\*: Limit values are valid from 01.01.2015







## 5.7 Test results at lowest output

Measurement	Result	Demands
Return temperature	48.97 °C	
Flow temperature	70.87 °C	
Water flow	0.30 m <sup>3</sup> /h	
Heat output	7.54 kW	
Test duration	6.00 h	
Power consumption	34.00 W	
Fuel consumption	1.65 kg/h	
Water content	6.9 %	
Calorific value	17744 J/g	
Heat input	8.14 kW	
Efficiency	92.7 %	87.9 (Class 5) 87.9 (Denmark) 83 (Austria)
Ambient temperature	22 °C	
Flue gas temperature	64 °C	
Chimney draught	4 Pa	
Flue gas volume flow	22.3 m <sup>3</sup> /h	
Flue gas mass flow	23.4 kg/h	
CO <sub>2</sub>	8.6 % <sub>vol</sub>	
Dust measured	31 mg/m <sub>n</sub> <sup>3</sup>	
Dust at 10% O <sub>2</sub>	38 mg/m <sub>n</sub> <sup>3</sup>	40 (Class 5)
Dust at 13% O <sub>2</sub>	0.0277 g/m <sub>n</sub> <sup>3</sup>	0.1/0.02* (Germany)
Dust emission	18 mg/MJ	60/30* (Austria)
CO measured	0.0155 % <sub>vol</sub>	
CO at 10% O <sub>2</sub>	0.0187 % <sub>vol</sub>	
CO at 10% O <sub>2</sub>	234 mg/m <sub>n</sub> <sup>3</sup>	500 (Klasse 5)
CO at 13% O <sub>2</sub>	0.1700 g/m <sub>n</sub> <sup>3</sup>	0.5/0.4* (Germany)
CO at 13% O <sub>2</sub>	170 mg/m <sub>n</sub> <sup>3</sup>	300 (Switzerland)
CO emission	111 mg/MJ	375 (Austria)
NO <sub>x</sub> (NO <sub>2</sub> ) at 10% O <sub>2</sub>	0.0073 % <sub>vol</sub>	
NO <sub>x</sub> (NO <sub>2</sub> ) at 10% O <sub>2</sub>	149 mg/m <sub>n</sub> <sup>3</sup>	
NO <sub>x</sub> emission (NO <sub>2</sub> )	71 mg/MJ	150/100* (Austria)
OGC (C <sub>3</sub> H <sub>8</sub> ) at 10% O <sub>2</sub>	0.0004 % <sub>vol</sub>	
OGC (C) at 10% O <sub>2</sub>	7 mg/m <sub>n</sub> <sup>3</sup>	20 (Class 5)
OGC emission (C)	3 mg/MJ	40 (Austria)

All emission values are stated on the basis of dry flue gas.

\*) Limit values are valid from 1.1.2015



